



ASUREX-A200
Automatic Suppressor Regenerator

Instructions for Use

Xenoic®

ASUREX-A200 Automatic Suppressor Regenerator

with **XAMS** Anion Membrane Suppressor

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General Information

The Xenoic® XAMS membrane suppressor and the Xenoic® ASUREX automatic regenerator are designed to maximize sensitivity in anion chromatography by minimizing the eluent background conductivity and noise. The robust and flexible design of ASUREX and XAMS ensures stable routine operation together with many different brands of ion chromatography systems and conductivity detectors.

The purpose of ASUREX is to maintain a constant acidic environment in the XAMS suppressor, where the ion chromatography eluent background conductivity is suppressed. Protons continuously supplied from the ASUREX-AR1 cartridge to the XAMS suppressor are transported across the suppressor ion exchange membrane into the eluent. There protons replace the cationic counter ions in the eluent (often sodium or potassium), thereby neutralizing the eluent ions to their corresponding acids (often carbonic acid or water) which have very low conductivity. The replaced eluent cations are transported out from the XAMS suppressor and deposited on the ASUREX cartridge. Anions on the other hand, cannot cross the suppressor membrane due to ion exclusion. The ASUREX-AS1 regeneration solution circulating in the ASUREX system is an ultra-pure organic acid that act as a vehicle for transport of protons between the ASUREX cartridge and the XAMS suppressor.

The ASUREX regenerator with XAMS suppressor is particularly well suited for applications requiring long, unattended routine operation, and exceptionally low and stable background conductivity. Gradient elution may also be carried out with minimal baseline drift, and the background level is unaffected if the user decides to change the mobile phase flow rate or ion strength to reduce the chromatographic run time. While convenient and cost-saving in laboratory applications, the ASUREX will really excel in applications such as environmental sampling in pristine areas, and for continuous industrial monitoring of high purity water.

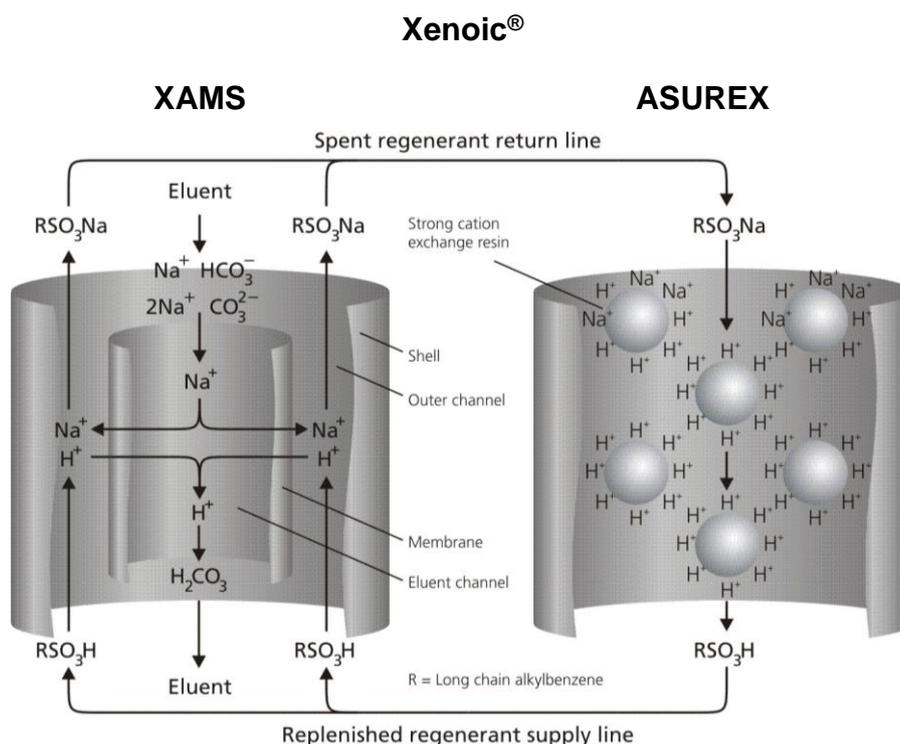


Figure 1: Ion exchange in a Xenoic® XAMS suppressor connected to Xenoic® ASUREX regenerator.

Unpacking

The ASUREX-A200 box contains the following items:

- ASUREX-A200 Pump (reorder number 1810-201)
- ASUREX-A200 Power supply 9 V (reorder number 1810-202)
- ASUREX-A200 Fitting kit (reorder number 1810-211)
- ASUREX-AR1 Cartridge, 0.5 L (reorder number 1810-911)
- ASUREX-AS1 Solution, 100 mL (reorder number 1810-921)
- XAMS Suppressor installation kit (reorder number 1125-711)
- Instructions for Use

Optional items supplied if ordered:

- XAMS Suppressor (reorder number 1125-100)
- XAMS-HC High-capacity suppressor (reorder number 1125-200)
- XAMS Pressure relief valve kit (reorder number 1125-721)
- XAMS Pressure optimizer kit (reorder number 1125-731)

Please confirm the delivery against the lists above.



Figure 2: All components of a Complete Starter Kit including XAMS suppressor, ASUREX-A200 regenerator with power supply, pressure relief valve, pressure optimizer and all interconnecting tubing.

Installation



Only use the included 9V DC power supply to power the ASUREX-A200 regenerator.

Connecting the ASUREX-A200

The ports on the rear of the ASUREX-A200 are for power input and enables relay remote control by other instruments, respectively.

Port		Description
	Micro USB	For computer control (not used).
	2.5 mm jack	For relay remote control.
	DC jack (center pos.)	For 9V DC power input.

Power Supply

The ASUREX-A200 Regenerator is powered by an external 9 V DC power supply delivering 2 A current. The ASUREX-A200 Regenerator powers up immediately when connected and enters idle mode. The successful power-up of ASUREX-A200 is indicated by the LED ring lighting up to a fading rainbow color plus the internal buzzer delivering a beeping sound once.

Relay Remote Control

The relay remote control operates as closed-on and open-off with a +5 V output and accepts +5 V as input, see Figure 3. To turn on the pump in this mode, connect the two poles of the remote cable via the relay output of your controlling instrument.

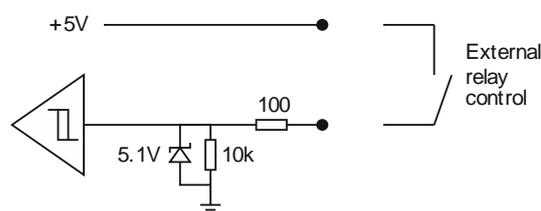


Figure 3: Circuit design for relay input control.

High Pressure or Leakage

The ASUREX-A200 has a built-in sensor that continuously measures the workload of the pump and every unit is calibrated to stop immediately if this is outside the specifications. This means that the ASUREX-A200 can never reach a too high pressure. The ASUREX-A200 also has a built-in leakage sensor that stops the pump if an internal leakage is detected. The safety check valve previously installed for older models of the ASUREX Regenerator is thus not required.

Diluting the ASUREX-AS1 Solution



Wear protective glasses and gloves during handling of the ASUREX-AS1 Solution.

The ASUREX-AS1 Solution contains an ultra-pure, high-molecular weight, polymeric sulfonic acid in water, which may be corrosive and irritate skin. Spills should therefore be avoided. The use of eye protective glasses and gloves during handling is strongly recommended.

The ASUREX-AS1 Solution is shipped as a concentrate and must be diluted with Reagent Grade Laboratory Water before use. A 1+4 dilution is recommended for eluent strengths up to 30 mM. Stronger and less diluted AS1 Solution should be used for gradients and strong eluents. For eluents 30-50 mM a 1+1 dilution of the AS1 Solution is recommended.

To make a 1+4 dilution, transfer all 100 mL of the supplied ASUREX-AS1 Solution to a 500 mL flask. Add and dilute with 400 mL Reagent Grade Laboratory Water. Mix the solution properly. Diluted AS1 Solution that is not used immediately should be stored in a plastic bottle in a cool place (ca 5-10 °C), but not below freezing.

Reagent Grade Laboratory Water is ultra-pure deionized water, free of organics, microorganisms and particulate, with a specific resistance of 18 Mohm cm⁻¹. Do not use water on bottle unless this is optimized for ion chromatography and is specified to contain very low levels of ions. Contamination of the AS1 Solution with ions will deteriorate the low background capability of the AS1 Solution and decrease the performance of the XAMS Suppressor.

Avoid using laboratory glassware when handling Reagent Grade Laboratory Water or any solutions (including eluents and diluents) prepared for use in suppressed ion chromatography, since they will release ions and increase the background level. Instead use plastic bottles which have been washed without use of detergents and rinsed in Reagent Grade Laboratory Water before use.

ASUREX-AR1 Cartridge



Failure to install the Vent Tubing to the ASUREX-AR1 Cartridge constitutes a risk for leakage, damage to equipment and health hazard for laboratory staff.

The AR1 Cartridge have three connections. The central one is used as outlet during operation. The connectors on the edge (which are identical) are used for inlet and vent, respectively. The vent is connected to an Expansion Flask to avoid pressure buildup of the circulating AS1 solution.



Figure 4: Connectors on the ASUREX-AR1 Cartridge.

Since the XAMS Suppressor is a membrane device, it is not entirely impermeable to water. Due to osmotic transfer of water between the AS1 Solution and the eluent taking place over the long lifespan of the AR1 Cartridge, the volume of the AS1 Solution may decrease, or more typically, increase. This means that some solution may leave the AR1 Cartridge through the waste tubing, but this has no effect on the performance of the system. Failure to install the Vent Tubing may cause build-up of pressure in the ASUREX Regenerator. This will affect the performance and constitutes a risk for leakage and damage to equipment and is a health hazard for laboratory staff.

XAMS Suppressor



Always disconnect the XAMS if the separation column is being washed with solutions containing high concentrations of salt. The ASUREX-AR1 Cartridge lifetime will otherwise be reduced and the XAMS Suppressor risks being poisoned by released contaminants.

For best results, the XAMS Suppressor should be installed close to the ion chromatography column. Extensive tubing between the column and suppressor or between the suppressor and detector will lead to band-broadening of the chromatographic peaks and loss of resolution. Optimum low level of background conductivity, noise and reproducibility are achieved when the XAMS is placed in a column oven or similar compartment with controlled temperature.

If your XAMS previously has been used with sulfuric acid or other low molecular-weight acids for regeneration, it must be flushed with minimum 50 mL of ultra-pure water to avoid contaminating the AS1 Solution. A contaminated AS1 Solution will result in a higher background level and more noise. For further information regarding handling of the XAMS and its operational limits, please consult its separate Instructions for Use.

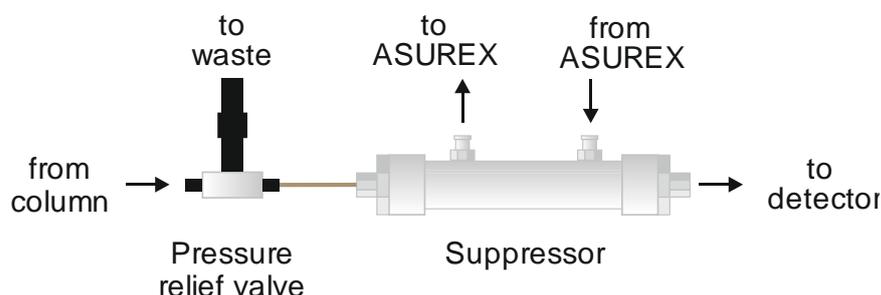


Figure 5: Connectors on the XAMS membrane suppressor and how to fit it to a pressure relief valve.

Pressure Relief Valve

It is highly recommended to install a 100 psi (7 bar) Pressure Relief Valve between your column and the XAMS to protect the suppressor against high backpressure. Without a Pressure Relief Valve, the XAMS Suppressor membrane will break and be irreparably damaged if the downstream pressure exceeds the limits of the suppressor.

Pressure Optimizer



Make sure the Pressure Optimizer Check Valve is installed correctly and do not install it if the Pressure Relief Valve has not been installed first.

To stabilize the pressure over the XAMS Suppressor membrane and thereby minimize noise, a Pressure Optimizer Check Valve can be installed after the detector. Before installing this, verify that the detector and downstream tubing do not give more than 5 bar backpressure at 1 mL/min eluent flow rate. Make sure the Pressure Optimizer Check Valve is installed in the correct direction and do not install it if the Pressure Relief Valve has not been installed first.

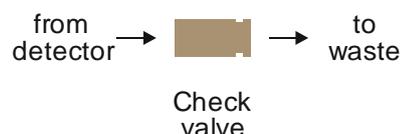


Figure 6: Pressure Optimizer Check Valve installed after detector.

Tubing for the AS1 Solution

The ASUREX Regenerator is supplied with pre-cut flexible tubing for the AS1 Solution to circulate through. Two pieces with open ends are included in the ASUREX Fitting Kit and three pieces with connectors in both ends are included in the XAMS Installation Kit.



Figure 7: Flexible pre-cut tubing included with the ASUREX automatic suppressor regenerator.

Installing and Filling the AR1 Cartridge

ASUREX-AR1 Cartridges are delivered empty and must first be filled with diluted AS1 solution. The ASUREX Pump is used for this procedure and it involves some temporary plumbing, according to the steps listed below and as shown in Figure 8. Wear protective gloves and glasses when performing the filling procedure.

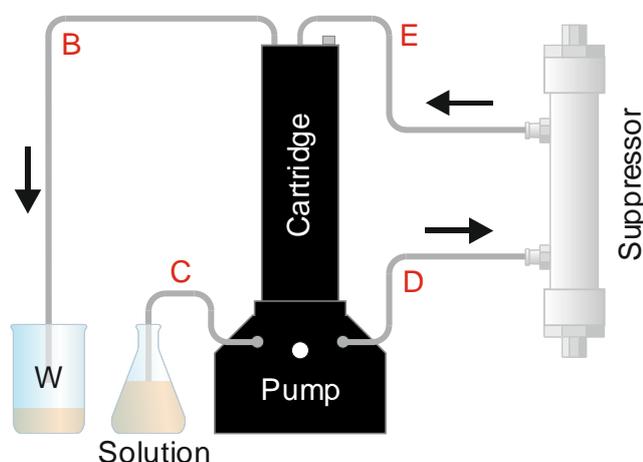


Figure 8: Tubing connections for filling the ASUREX AR1 Cartridge.

1. Install the Cartridge in the holder at the top of the Pump.
2. Remove the Luer Plugs on the Cartridge from the central connector and one of the edge connectors.
3. Connect a short open-end tubing (B) to the inlet (edge) of the Cartridge and place the other end in a suitable Waste bottle (W).
4. Connect a short tubing (C) to the Pump inlet (left) and place the other end of the tube in the flask containing the diluted AS1 Solution.
5. Connect a long tubing (D) between the Pump outlet (right) and the XAMS suppressor inlet (lower)
6. Connect a long tubing (E) between the XAMS Suppressor outlet (upper) and the Cartridge outlet (centre).
7. If no XAMS suppressor is present, use a luer union to connect the two pieces of long tubing (D & E)
8. Start the Pump and let it operate until about 200 mL of the diluted AS1 Solution has emerged to waste. Save the remaining approx 200 mL of diluted AS1 Solution for future refilling needs. Store it in a plastic bottle cold, but not below freezing.
9. Stop the Pump.

Starting the ASUREX Regenerator with a XAMS Suppressor



Before you start the ASUREX Pump for normal operation, ensure that the connecting tubing are assembled correctly.

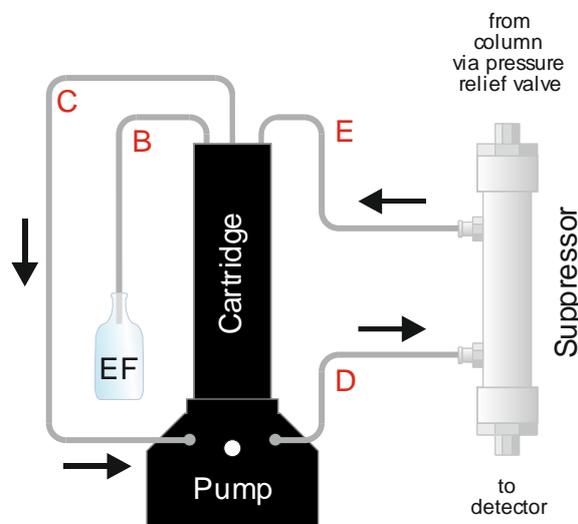


Figure 9: Tubing connections during normal operation the ASUREX System. Tubing B is connected to the Expansion Flask (EF) from the Cartridge Vent.

1. Connect the tubing according to the filling procedure if this has not been performed recently.
2. Replace the Waste bottle (W) with an Expansion Flask (EF).
3. Remove the last Luer Plug on the Cartridge from the edge connector.
4. Move the long return tubing (E) which was connected to the suppressor, from the outlet (central) connector, to the inlet (edge) connector on the cartridge.
5. Move the short tubing (C) from the bottle with AS1 Solution and connect this to the outlet (central) connector on the cartridge.
6. Start the ASUREX-A200. During operation the flow rate will be about 50 mL/min with a backpressure in the regeneration channel of 1-2 bar (14-30 psi).
7. Flush your ion chromatography eluent pump system thoroughly with purified water if it has not recently been used for suppressed anion chromatography. Use fresh eluents and wash solutions free from organic solvents.
8. Connect the XAMS eluent inlet (top) to the tee union with a pressure relief valve (100 psi, ordered separately) and then to your separation column outlet using the supplied 0.25 mm ID PEEK tubing. The exit from the Pressure Relief Valve is connected to your eluent waste.
9. Connect the XAMS eluent outlet (bottom) to your detector.
10. Start your eluent pump and let the system equilibrate for at least 30 minutes. Monitor the baseline of your chromatography system to determine when the suppression is stable.



Failure to install the Vent Tubing to the ASUREX-AR1 Cartridge constitutes a risk for leakage, damage to equipment and health hazard for laboratory staff.

Operation

Operating the ASUREX-A200

The ASUREX-A200 Regenerator is very easy to use. One push-button on the front controls everything including start and stop, plus any error confirmation. The LED ring use different colors to indicate the status of the regenerator and an internal buzzer sounds whenever the unit's status change.

Indication		ASUREX-A200 Status
	Fading rainbow	Idle. Power connected but pump is off.
	Pulsating green	On. Pump is operating.
	Fixed blue	Remote controlled idle. Pump is off.
	Pulsating blue	Remote controlled on. Pump is on.
	Flashing red and sound	<p>Error! Pump has stopped!</p> <p>Correct the cause of the error and press and hold the button for 3 seconds to return to idle state.</p> <p>One beep followed by short silence indicates too high backpressure.</p> <p>Two beeps indicate internal leakage.</p> <p>Three beeps indicate high backpressure and internal leakage.</p>

The status of the ASUREX-A200 Regenerator changes immediately to remote control mode when the 2.5 mm jack cable is plugged in. When in remote control mode, the front push-button is disabled and the LED ring switch to blue. To turn on the pump, connect the two poles of the remote cable via the relay output of your controlling instrument.

Air Bubbles

During operation of the ASUREX-A200 Regenerator, air bubbles may sometimes appear within the circulating AS1 solution. This does not affect the performance unless air is accumulating in the XAMS Suppressor. To avoid this, the XAMS regeneration channel outlet should be positioned slightly higher than the inlet.

Optimum Performance

The level and stability of the background conductivity will improve during the first operating hours of a new cartridge. Monitor the background level and noise through your conductivity detector and ion chromatography system software.

To get the most stable background, the ASUREX Regenerator should be operated also when the eluent flow has been stopped temporarily, such as during nights. When eluent is not pumped through the suppressor, protons in the AR1 cartridge and AS1 solution are not “consumed”. The cartridge lifetime will therefore not be negatively affected by continuous recirculation.

The most optimal performance is obtained when the ASUREX-AR1 Cartridge is placed within the ion chromatography system compartment (column oven or similar), avoiding exposure to direct sunlight and other major temperature variations. The AR1 Cartridge should always be kept in an upright position during operation.

To obtain the lowest background level and noise with hydroxide eluents after use of carbonate eluents, the AR1 Cartridge should be completely drained from old AS1 Solution. After drain, a freshly prepared AS1 Solution should be filled into the AR1 Cartridge with about 200 mL overflow as described in the filling procedure.

Eluents and Gradients

Eluents for suppressed ion chromatography should always be prepared from ultra-pure Reagent Grade Laboratory Water that have been prepared the same day and ideally within 20 minutes before use. Eluents should always be stored in plastic bottles to avoid contamination from ions released from glass vessels. Eluents should never be exposed openly to ambient air since they will spontaneously absorb carbon dioxide and thereby modify the eluent composition. This is especially important when working with hydroxide eluents and when performing trace level analysis.

To suppress stronger eluents and gradients completely using the XAMS suppressor, the ASUREX-AS1 Solution should be made stronger and less diluted. For eluents 30-50 mM, a 1+1 dilution is recommended. For weaker eluents, a 1+4 dilution of AS1 Solution is recommended.

The XAMS-HC high-capacity suppressor is recommended for eluents 50-100 mM. With the XAMS-HC suppressor a 1+1 dilution of the ASUREX-AS1 Solution is always recommended. XAMS-HC may also suppress eluents 100-150 mM but then the baseline noise will increase.

Temporary Storage



Store diluted ASUREX-AS1 Solution and filled ASUREX-AR1 Cartridges plugged in a refrigerator at 5-10 °C.

Keep the ASUREX Regenerator in continuous operation during analysis even if the eluent flow is temporary stopped. However, if the ion chromatography system will not be used for a couple of days, it is recommended that the regeneration flow is stopped.

If the ion chromatography system will not be used for several weeks, it is recommended that the AR1 Cartridge is removed and plugged and that the Pump flow path is flushed with deionized water for about 10 minutes. The Pump should finally be drained by pumping air for one minute. Prolonged operation without liquid in the Pump may lead to increased wear of the internal parts and is not recommended. Failure to flush the Pump when disconnected might result in precipitation of AS1 solution and clogging of the system. Prolonged storage of filled and plugged Cartridges and diluted AS1 solution should be performed at cold temperatures (ca 5-10 °C), but not below freezing.

Expected Cartridge Lifetime

Eluent cations will break through the Cartridge before it is completely exhausted and a slight increase in background conductivity and noise indicates that a new Cartridge soon need to be installed. The practically useful capacity of the ASUREX-AR1 Cartridge (0.5 L) is about 0.8 eq. Table 1 shows the expected practical AR1 Cartridge lifetime when used with some typical anion chromatography eluents.

Table 1: Expected practical lifetime of the ASUREX-AR1 Cartridge (0.5 L) when used with some typical eluents for anion chromatography. Lifetimes at other eluent concentrations or flow rates may be extrapolated from the tabulated estimates.

Eluent Type and Concentration			Flow Rate	Estimated useful lifetime
NaOH <i>mM</i>	Na ₂ CO ₃ <i>mM</i>	NaHCO ₃ <i>mM</i>	<i>mL min⁻¹</i>	Full eight-hour working days <i>ea</i>
5.0	-	-	1.0	330
10.0	-	-	1.0	165
-	1.8	1.7	1.0	320
-	1.8	1.7	2.0	160

Disposal of ASUREX-AR1 Cartridges

The ASUREX-AR1 Cartridge housing is made from polyvinyl chloride (PVC) and the interior filling is a sulfonated polystyrene cation exchange resin. Unless you are required to recycle different types of plastics separately, we recommend that the AR1 Cartridge is thoroughly washed with water and recycled as an all-plastic waste.

Disposal of ASUREX-AS1 Solution

The chemical composition of the ASUREX-AS1 Solution is quite similar to dishwashing detergents. This means that the solution can be safely disposed in the drain if flushed with plenty of water.

Disposal of XAMS Suppressors

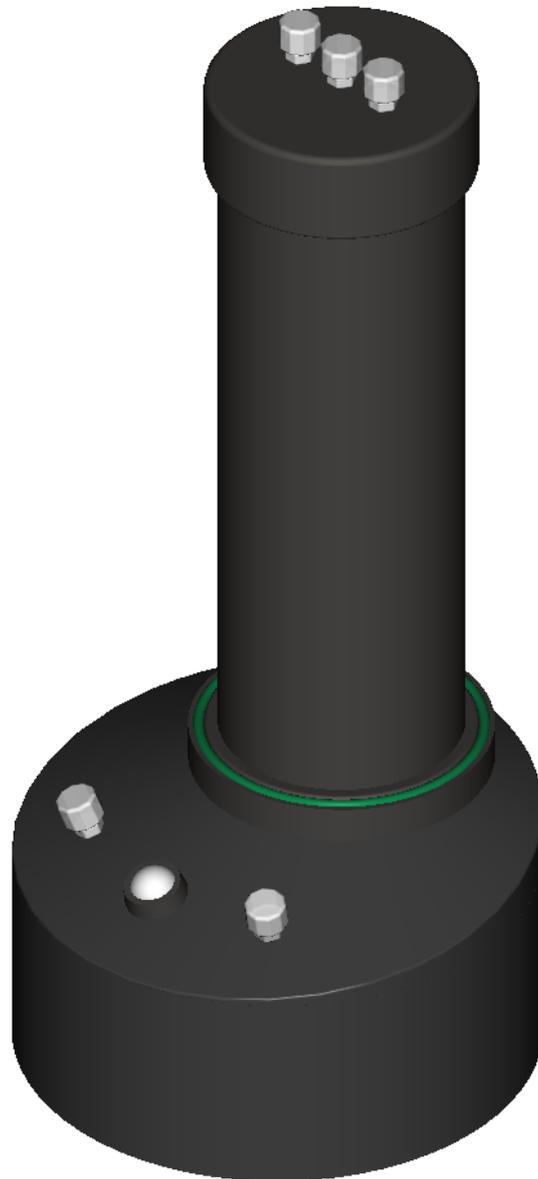
The XAMS housing is made from polyvinylidene-fluoride (PVDF) and polyether-ether-ketone (PEEK). After being thoroughly flushed with water, XAMS can be recycled as an all-plastic waste unless you are required to recycle different types of plastics separately.

Reference

Reordering Information

Please contact Diduco AB or your local Xenoic® distributor for placing your order.

Ord. No.	Description
1125-100	Xenoic® XAMS Anion membrane suppressor
1125-200	Xenoic® XAMS-HC High-capacity anion membrane suppressor
1125-711	Xenoic® XAMS Installation kit
1125-721	Xenoic® Pressure relief valve kit (100 psi)
1125-731	Xenoic® Pressure optimizer kit
1810-200	Xenoic® ASUREX-A200 Automatic suppressor regenerator
1810-202	Xenoic® ASUREX-A200 Power supply
1810-211	Xenoic® ASUREX-A200 Fitting kit
1810-911	Xenoic® ASUREX-AR1 Cartridge (0.5 L, capacity 0.9 eq)
1810-921	Xenoic® ASUREX-AS1 Solution (100 mL to be diluted 1+4)



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